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Joint Mobilization: Theory and evidence review

Lucky Anggiat[1], Andrei Joseph Altavas[2], Weeke Budhyanti[1]*

1 *Faculty of Vocational Studies, Physiotherapy Program, Universitas Kristen Indonesia, Jakarta, Indonesia*

2 *Physical Therapy Advancement Seminars, Florida, United States of America*

Abstract

Joint mobilization is one of integral part in the application of manual therapy. In the development of the physiotherapy profession, the term of joint mobilization began to be used which was the development manipulative manual therapy with gradual force. In practice, physiotherapists often rely on only one well-known method to practice manual mobilization therapy and / or compare with other well-known methods. In general, the manual joint mobilization therapy was first developed by Kaltenborn, then followed by Maitland and then came another manual therapy with the approach of each of its inventors such as McKenzie and Mulligan. From the results of previous research articles, it was found that all joint mobilization manual therapy techniques did not have any differences in treating musculoskeletal disorders in general. Joint mobilization by any method still gives good results in general musculoskeletal disorders. The basic theories of manual therapy such as arthrokinematics, osteokinematics, grade of mobilization and their development needs to be well understood so as not to be mistaken in its clinical application in patients. The effects of manual therapy on musculoskeletal disorders are still theoretically relevant to the results of recent studies.

Keywords: Joint Mobilization, Manual Therapy, Physiotherapy, Review.

***Corresponding author:**
Lucky Anggiat
Faculty of Vocational Studies, Physiotherapy Program, Universitas Kristen Indonesia, Jakarta, Indonesia
Email: lucky.panjaitan@uki.ac.id

INTRODUCTION

The joint mobilization is one of the techniques used in the manual therapy as a whole. In other words, joint mobilization is one of integral parts in the application of manual therapy [1]. Initially, manual therapy was found by an ancient doctor who is famous in medical circles namely Hippocrates (460-355 BC). He invented manual therapy for the first time using the method of spinal cord pulling by hanging the patient and moving the sore spine. Hippocrates used manual therapy at that time because there were so many cases of scoliosis [2, 3, 4]. Hippocrates also wrote several books on handling joint dislocation conditions with manual therapy which was developed later in the following year [3, 5].

Furthermore, manual therapy began to be developed by several people and doctors, as well as traditional healers which is the bone setters [6]. However, scientifically, it was not being studied by many people. Along with the development of bone setters, manual therapy began to be developed in the medical field by Andrew Taylor Still who created the osteopathic technique and eventually produce a new profession called Doctor of Osteophaty (DO) profession [3]. This technique is also known as the manipulative therapy [4, 6]. Later, the technique developed rapidly and became a profession equivalent to a medical doctor at that time. Thereafter, there was the development of the chiropractic profession which was developed by someone who did not come from medicine but studied the art of healing including the manual therapy of Hippocrates and Still [6]. It was David Daniel Palmer who later created this new method with an approach to natural healing [7]. Increasingly developed, chiropractic then became a profession that was also equivalent to a doctor or called a Doctor of Chiropractic (DC) [3].

Then the two professions continued to develop and produce several books that could be studied by other professions. The orthopedic doctor profession then began to transform into Orthopedic Medicine with physical treatment in the form of massage, exercise and manipulation [8, 9]. In 1954, Orthopedic Medicine, better known made by James Mennell and Edgar Cyriax, was developed further by the son of Edgar Cyriax, namely James Henry Cyriax, who also provided training in Orthopedic Medicine for other professions, one of which was physiotherapy [4].

In the development of the physiotherapy profession, the term of joint mobilization began to be used which was the development manipulative manual therapy with gradual force. Freddie Kaltenborn first gave his thoughts in books and manual therapy techniques with joint mobilization in 1940 [10].

Kaltenborn studied osteopathic and orthopedic medicine which was the basis of his thoughts in determining the grade of mobilization in the manual therapy. The grade is divided into three grades. Later, Kaltenborn also invented the methods for joint examination called arthrokinematic and osteokinematic which were used to determine the direction of mobilization [11]. Several years later, Robin McKenzie also provided a philosophical development in the manual therapy by combining several other movement positions that are more focused on spinal disorder [12].

The joint mobilization technique of Kaltenborn was then developed by several physiotherapists such as Stanley Paris from New Zeland and Robin McKenzie in 1950-1966 [4, 12]. Subsequently, the joint mobilization was developed further by Geoff Maitland who came from Australia in 1964-1968 [4, 13]. Maitland then developed the joint mobilization technique of Kaltenborn with some influence of Cyriax, with four grades of mobilization and one grade of manipulation. Manual therapy training was also developing among physiotherapists [12]. The development of this training led to the establishment of an organization in manual therapy, namely the International Federation of Orthopedic Manual Physical Therapists in 1974. This organization was established to equalize perception in the application of manual therapy among physiotherapists, including definitions, manual therapy learning standards that can be adapted by all physiotherapists in the world [1]. In 1989, a physiotherapist named Brian Mulligan then developed the technique of Kaltenborn and Maitland [14]. The joint mobilization therapy developed by Mulligan is a technique that is quite well known for its development that was different from the joint mobilization of Kaltenborn and Maitland, namely using a combination of movements in the joints or osteokinematics and movement of the joint surface [15].

Out of all these joint mobilization techniques, physiotherapists began to develop themselves through training with the approaches of Kaltenborn, Paris, McKenzie, Maitland as well as Mulligan. Starting from these various techniques, research results have begun to develop and provide quite significant results by promoting particular joint mobilization therapy techniques [16, 17, 18]. The selection of research results need to be considered so as not to deviate in the application of the joint mobilization therapy used by physiotherapy.

From the background that has been described, there is still little literature that raises a method of implementing joint mobilization in general musculoskeletal disorders. Thus, in practice, physiotherapists often rely on only one well-known method to practice joint mobilization and/or compare with other well-known methods [19, 20, 21, 22]. Consequently, a literature review study is needed to make conclusion about the effectiveness of joint mobilization techniques in general musculoskeletal condition. In the definition provided by the International Federation of Orthopedic Manual Physical Therapy, joint mobilization in manual therapy is passive mobilization specifically in joints, whether manually or mechanically, with rhythmic and slow movements [23]. Furthermore, the IFOMPT guidelines do not explain which method is the best or the priority. Thus, there needs to be a research to the basic joint mobilization techniques in general without prioritizing comparison with other methods. This research aims to theoretically reviewing the manual therapy of joint mobilization and the evidence of research in musculoskeletal disorders in general that exists in physiotherapy practices.

METHOD

The method in this study was used a literature review with library research, which is searching for literature related to the joint mobilization manual therapy used by physiotherapists as a standard reference for manual therapy and research results. In the introduction, a study of the theory of joint mobilization was carried out, both from reference books and the materials from the world organizations dealing with manual therapy. Secondly, continue with searching for research results in the form of systematic reviews related to the application of joint mobilization in general musculoskeletal disorders through online databases such as Google Scholar, Med-line, Pubmed, PEDro, and other journal sources. The systematic review articles included in this study only addressed with keywords “manual therapy” or “joint mobilization” without representing one or two manual therapy techniques. Articles in the form of systematic reviews on one method or comparisons of several methods are not included in this study. The research results included in this study are only of the last five years which is from 2015-2020. The results of the search were then described briefly in descriptive and concluded.

RESULTS AND DISCUSSION

Joint Mobilization Theory

Theoretically, joint mobilization is determined through the movement of bones or osteokinematics and arthrokinematics or also called movement in the bone surface [10]. The Concave and Convex theory developed by Kaltenborn also becomes the basis to direct the mobilization to the joint surface [11]. Kaltenborn explained that the joint movement in the convex bone surface against the concave joint surface will result in a glide in the opposite direction from the movement of the convex bone surface. Subsequently, the movement of the concave bone surface against the convex bone will result in a glide in the same direction as the convex movement. From this theory, the direction of the mobilization pressure can be determined by the therapist. Then, with the direction of the mobilization pressure being moved based on the glide in the arthrokinematics, it is expected that the osteokinematic movement can be increased [24, 25, 26].

In addition, joint positioning is also known in the manual therapy. The joint position is divided into two, namely the open pack position (OPP) and the closed pack position (CPP) [11]. In practice, however, the joint position may change according to the development of the application of joint mobilization. In arthrokinematic movement, there are the terms of traction or distraction, which means a pull between two joint surfaces. Distraction is best performed in the OPP position because the joint is in a loose position [25, 26].

The grade of joint mobilization is something most often applied in the manual mobilization therapy [24]. However, the method of McKenzie and Mulligan does not use grade in mobilization. The mobilization grade was firstly developed by Kaltenborn in three grades [4, 11]. The grade I is called Loosen, where the pressure is applied with small amplitude when the glide is not too strong. The grade II in Kaltenborn is Tighten, where the glide pressure is strong enough to put pressure on the tissues around the joint. Grade I are II are applied within the limits of movement of the joint surface that can be done. Subsequently, the grade III is also called stretch. Grade III provides elongation in a position where the movement of the joint surface is limited or what is called the first stop.

Kaltenborn, explains that grade I-III have different goals and results [10]. In general, grades I-II in Kalternborn are aimed at conditions of pain and relaxation of soft tissue around the joints. The use of oscillation is also intended to increase the viscosity of the fluid in the joints. Meanwhile, grade III is aimed at joint conditions where the soft tissue shortens around the joints or the condition of joint hypo mobility.

Maitland developed the method of Kaltenborn and made more general definitions, namely physiological movement (osteokinematic) and accessory movement (arthrokinematic) [4, 13, 26]. However, the use of concave and covex law discovered by Kaltenborn is still used to determine the direction of joint mobilization [4, 27]. Moreover, some understandings from Kaltenborn such as close pack position and open pack position are still used by the Maitland method.

In the joint mobilization approach presented by Maitland, the examination is carried out uniquely using a movement diagram [13, 28]. With the movement diagram approach, the first stop and the second stop, which are called Resistance 1 (R1) and Resistance 2 (R2) by Maitland, are known. The use of R1 and R2 is to determine the grade of joint mobilization to be applied to the patient [4].

Through the use of R1 and R2, Maitland described the stage of the mobilization grades into 4 with the fifth grade is the joint manipulation that most frequently used in manual therapy today [13, 26, 28]. Grades I and II are applied at R1 limit with the explanation that grade I is a small amplitude mobilization close to the initial movement of the joint glide. Meanwhile, grade II is a large amplitude mobilization from the limit of grade I to R1. Furthermore, in order to pass R1, the mobilization of grade III and grade IV is applied. Grade III is a large amplitude mobilization with a range of movement from R1 up to mid R2. Meanwhile, grade IV is the movement of small amplitude mobilization up to R2 or the ultimate point of the anatomically limited joint [4, 26].

Maitland explained that grade I-II mobilization has a neurophysiological effect that can reduce pain in joints [13]. Grade III-IV can have an effect on increasing the range of movement of the joints by reducing movement restrictions from the soft tissue stiffness around the joints [25]. Furthermore, the use of grade III-IV is aimed at joint conditions where muscle tension of muscle spasm occurs. However, under these conditions, grade III-IV will also produce analgesic effects [4, 26, 27].

Another type of joint mobilization is the McKenzie method. Robin McKenzie is one of Cyriax's students who specializes in reducing pressure on nerves [29]. However, the McKenzie method does not use the concave and covex principles in joints because initially this method was a method specialized in dealing with spinal cord compression. McKenzie also stated that the joint mobilization he developed is included in the realm of exercise and do-it-yourself therapy by the patients [30]. The most popular terms in the McKenzie method are the repeated movement and directional preference, which is the direction of movement that the patient likes or is able to do [4, 30]. Furthermore, McKenzie also suggested using joint mobilization by any method to increase the therapeutic effects in the manual therapy he was developing.

Brian Mulligan also developed a joint mobilization method called the Mulligan Concept. The Mulligan Concept is also a development of the Kaltenborn method [14]. The concept of mobilization by Mulligan continues to use the concept given by Kaltenborn with the addition of one dimension of the direction of mobilization. This mobilization is known as the most frequently used method called the Mobilization with Movement (MWM) [14, 31, 32]. Simply put, MWM is a joint mobilization in a two-dimensional direction (such as Kaltenborn) and then together with the physiological or osteokinematic movement of the joint so as to become a three-dimensional joint mobilization, provided that the use of this mobilization must be in pain free conditions [15, 31].

From of all the theoretical concepts of joint mobilization, the International Federation of Orthopedic Manipulative Physical Therapy (IFOMPT) explains that joint mobilization is the application of passive movement techniques in joints both manually and mechanically, slowly and rhythmically, according to patient needs [23]. The rhythm may be in the form of oscillation (repetition) or a steady stretch. The joint mobilization techniques described are also arthrokinematic and osteokinematic movement techniques, angular movement, distraction and compression. Joint mobilization is carried out by paying attention to symptoms such as pain, muscle tension, and end feel. Thus, all methods that are performed specifically may mean joint mobilization in manual therapy. Olson, explained that joint mobilization as well as manipulation will theoretically produce mechanical effects in the form of improving the scope of movement of the joint, stretching the stiff tissue [33]. Furthermore, the neurophysiological effect is to reduce pain by stimulating mechanoreceptors. Another effect that was also explained is the psychological effect on patients, namely the placebo effect and the increased patient expectations due to the interaction of the therapist with the patient.

Evidence Review on Joint Mobilization Manual Therapy

From this present research, there are only a few studies of systematic review related to joint mobilization in general musculoskeletal disorders. There are only three systematic review articles in the journal reviewing the use of joint mobilization which do not support one particular method in the condition of musculoskeletal disorders, particularly in joint and muscle disorders. Table 1 briefly presents the articles obtained from searching in terms of authors, research designs and research conclusions.

Table 1: Article search in terms of authors, research designs and research conclusions

Author (Year)	Focus	Research Design	Conclusion
Voogt *et al*. (2015)	Effects of manual therapy interventions directed to both spinal and peripheral joints on pain thresholds of patients with musculoskeletal pain	Systematic review	Moderate evidence indicated that manual therapy decreased local pressure pain thresholds in musculoskeletal pain, immediately following intervention. No significant changes occured on thermal pain threshold values. The clinical relevance of these effects remains contradictory and therefore unclear
Pfluegler *et al*. (2020)	Effect of passive joint mobilisations on the function of muscles surrounding the targeted joints in symptomatic as well as asymptomatic individuals.	Systematic Review	Current best evidence suggests that passive joint mobilisations have the ability to immediately alter muscle function. There is a moderate level of evidence that joint mobilisation immediately decreases the activation of superficial muscles during low load conditions in symptomatic individuals, suggesting an increase in deep muscle recruitment, hence an improved motor pattern. There are contradictory findings regarding the ability to alter maximum muscle strength; a low level of evidence for asymptomatic individuals indicates that joint mobilisation can improve maximum muscle strength, opposed to a very low level of evidence suggesting no such improvement in symptomatic individuals.
Abner *et al*. (2020)	Effect of joint mobilization on chronic musculoskeletal pain	Systematic Review	According to the results of this review, joint mobilization seems to be an effective technique for CMP, when applied alone or in association with other interventions, once it causes pain intensity decrease, improvement on range of motion, strength, functionality, quality of life, with good patient adherence/satisfaction and low adverse events. Based on this review, no specific clinical recommendations can be made on the optimal dose of treatment through joint mobilization. Future clinical trials should investigate mobilization types and the dose of treatment according to different musculoskeletal diseases

The research conducted by Voogt *et al*. was reporting about manual therapy techniques in general which included the Mulligan technique, manipulation, the Kaltenborn and Maitland mobilization with a total of 14 systematic review articles [34]. From the searching results in their research, almost all musculoskeletal disorders are presented so that the results of their research can be considered comprehensive and complete. Furthermore, the results of their research explained that all types of manual therapy can reduce musculoskeletal disorders which also include joint mobilization by any method. They even further explain that neither mobilization nor manipulation is superior in dealing with musculoskeletal disorders. In addition, they conclude that manual therapy should be combined with other therapies to reduce pain in musculoskeletal conditions.

Thereafter, Pfluegler *et al*. [35] conducted a study that specifically addresses common joint mobilization techniques. They only searched for the results of research on passive joint mobilization by a comparison with sham mobilization or other manual mobilization therapy techniques. With the same systematic review method, they found 17 articles on common joint mobilization methods. Specifically, they analyzed the effects of joint mobilization therapy in asymptomatic and symptomatic patients which those with musculoskeletal disorders and those without musculoskeletal disorders, by taking into account the effects of mobilization on muscle functions (muscle activity, maximum muscle strength, and spinal reflex excitability). Furthermore, the results of their research did not find all musculoskeletal disorders in every joint, but they found more articles on spinal disorders. In general, they were very specific by only searching for articles on the study results of joint mobilization at grades I-IV and distraction without manipulation. Thus, their research was quite comprehensive in analyzing the joint mobilization. In their conclusion, passive joint mobilization has an effect on muscle function. However, this conclusion still requires the development of basic research in the future to find out the mechanism of changing of the muscle function from joint mobilization.

Finally, there is the research by Abner *et al*. who investigated joint mobilization for chronic musculoskeletal pain [37]. Their systematic review method is the same as the two previous studies. They found a total of 14 articles which contain almost all joint disorders except the ankle joint. However, their study summarizes the results of manual joint mobilization therapy coupled with other therapies (such as massage, exercise, electro physical agents and stretching). In their search results, they also included various methods of manual mobilization therapy such as Cyriax, Maitland, Mulligan and Kaltenborn. In their conclusion, they stated that joint mobilization is quite effective in chronic musculoskeletal pain conditions in almost every joint. Furthermore, the manual therapy using only joint mobilization or using other additional therapies may have a good effect in any evaluation of musculoskeletal disorders. Although their research studied every method of joint mobilization, they did not recommend either method alone.

From all research results and discussions, this present study has a number of limitation. This research is a simple review research model instead of a systematic review. The searching method in this study is also limited to the results of systematic review articles that is specific to joint mobilization for general musculoskeletal disorders. Furthermore, research on joint mobilization for specific musculoskeletal disorders is highly necessary in the future to provide a better perspective on the use of joint mobilization in general musculoskeletal disorders.

CONCLUSION

Based on the searching results, it can be concluded that joint mobilization by any method still gives good results in general condition of musculoskeletal disorders. The basic theories of manual therapy such as arthrokinematics, osteokinematics, grade of mobilization and their development needs to be well understood so as not to be mistaken in its clinical application in patients. The effects of manual therapy on musculoskeletal disorders are still theoretically relevant to the results of recent studies.

Recommendation

As a recommendation, the physiotherapist may use each method of joint mobilization without discrimination. Physiotherapists may develop the practical ability of joint mobilization manual therapy in various methods but still with a strong theoretical basis and use the methods according to patient needs.

Conflict of Interest

Author has no conflict of interest to declare.

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